forest management note

Note No. 27 Northern Forest Research Centre Edmonton, Alberta

WEIGHT TABLES FOR IMPORTANT TREE SPECIES IN THE NORTHWEST TERRITORIES

Foresters use volume tables to estimate the volume of the usable portion of forest trees. The unused tree parts left as residues are now gaining recognition as a potential source of energy. As the bulk of such residues may be from nonstem components, it is difficult to measure and present their quantities in volumetric units. Ovendry weight is the universally adopted measurement for quantifying forest biomass of all components.

Weight tables for the 10 major tree species of the prairie provinces have been published by Singh (1982) on the basis of diameter outside bark at breast height (D) and total height of the tree (H), because D and H are the most commonly measured characteristics of a forest tree. A similar approach was adopted in deriving the prediction equations for the six major tree species of the Northwest Territories reported in this Note.

The ovendry weight (W) of the entire tree above ground was estimated from the regression equations based on the model

$$W = a_0 + a_1 D^2 H$$

where the regression coefficients (a_0, a_1) were determined from the experimental data by the method of least squares.

The data used for the derivation of regression equations consisted of field and laboratory determinations made on 336 trees belonging to six major tree species of the Northwest Territories. The sampling was done primarily around Hay River, Fort Smith, and Fort Simpson. Details of sampling, laboratory procedures, and computer computations are described by Singh (1983a, b).

The tables cover the 6-40 cm diameter range in 2-cm increments and the 6-28 m height range in 2-cm increments. For the values of D and H between the listed weights, the biomass estimates may be obtained either from the regression equation given at the bottom of each table or by interpolation. The extension of weight tables beyond the indicated diameter and height range combinations is not recommended.

The tables provide ovendry biomass estimates for the aboveground portion of the tree with foliage and without foliage. The difference in the estimates obtained for the two will yield an estimate of the ovendry biomass weight of the foliage.

ACKNOWLEDGMENTS

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T. Singh
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Balsam poplar (*Populus balsamifera* L.) whole tree aboveground biomass (kg) with foliage

Dbh (cm)	Height (m)											
	6	8	10	12	14	16	18	20	22	24	26	28
6	1.9	2.9	4.0									
8	4.4	6.2	8.1	10.0								
10		10.5	13.4	16.4	19.3							
12			19.9	24.1	28.4	32.6						
14			27.6	33.3	39.1	44.9	50.6					
16				43.9	51.5	59.0	66.5					
18				55.9	65.5	75.0	84.5	94.1				
20					81.1	92.9	104.7	116.5				
22					98.4	112.7	126.9	141.2	155.4			
24						134.4	151.3	168.3	185.2	202.2		
26						157.9	177.8	197.7	217.6	237.5	257.4	
28							206.4	229.5	252.6	275.7	298.8	321.8
30							237.2	263.7	290.2	316.7	343.1	369.6
32							270.0	300.2	330.3	360.5	390.6	420.8
34								339.0	373.1	407.1	441.1	475.2
36									418.4	456.6	494.7	532.9
38									466.3	508.8	551.3	593.9

Equation: $W = -1.29892 + 0.01472D^2H$ ($R^2 = 0.89$, N = 55)
Equation based on D only: $W = -19.78931 + 4.01599D - 0.05686D^2 + 0.00744D^3$
($R^2 = 0.89$, N = 55)

Balsam poplar (*Populus balsamifera* L.) whole tree aboveground biomass (kg) without foliage

Dbh (cm)	Height (m)											
	6	8	10	12	14	16	18	20	22	24	26	28
6	1.3	2.4	3.4									
8	3.8	5.6	7.5	9.3								
10		9.8	12.6	15.5	18.4							
12			19.0	23.2	27.3	31.5						
14			26.5	32.2	37.8	43.5	49.2					
16				42.6	50.0	57.4	64.7					
18				54.4	63.7	73.1	82.4	91.8				
20					79.1	90.6	102.2	113.7				
22					96.1	110.0	124.0	138.0	152.0			
24						131.3	147.9	164.6	181.2	197.8		
26						154.4	173.9	193.4	213.0	232.5	252.0	
28							202.0	224.6	247.3	269.9	292.6	315.2
30							232.1	258.1	284.1	310.1	336.1	362.1
32							264.4	293.9	323.5	353.1	382.7	412.2
34								332.1	365.4	398.8	432.2	465.6
36									409.9	447.4	484.8	522.2
38									456.9	498.6	540.3	582.0

Equation: $W = -1.79052 + 0.01444D^2H$ ($R^2 = 0.89$, N = 55)
Equation based on D only: $W = -18.16371 + 3.56164D - 0.03293D^2 + 0.00690D^3$
($R^2 = 0.89$, N = 55)

Black spruce (*Picea mariana* (Mill.) BSP) whole tree aboveground biomass (kg) with foliage

Db (c	Height (m)								
	6	8	10	12	14	16	18	20	22	24
6	10	13.7								
8	15.3	17.5								
10	19.0	22.3	25.6							
12		28.2	33.0	37.8						
14		35.1	41.7	48.2	54.8					
16			51.7	60.2	68.8	77.3				
18			63.0	73.9	84.7	95.5	106.3			
20				89.1	102.5	115.8	129.2	142.5		
22				105.9	122.1	138.3	154.4	170.6	186.8	
24					143.6	162.8	182.1	201.3	220.6	239.8
26					167.0	189.6	212.1	234.7	257.3	279.9
28						218.4	244.6	270.8	297.0	323.2
30						249.4	279.5	309.5	339.6	369.7
32							316.7	350.9	385.1	419.4
34							356.4	395.0	433.6	472.3

Equation: $W = 6.93214 + 0.01670D^2H$ ($R^2 = 0.95$, N = 51)
Equation based on D only: $W = 1.51752 - 0.96880D + 0.29833D^2 + 0.00092D^3$
($R^2 = 0.92$, N = 51)

Black spruce (*Picea mariana* (Mill.) BSP) whole tree aboveground biomass (kg) without foliage

Dbh (cm)	Height (m)									
	6	8	10	12	14	16	18	20	22	24
6	7.8	9.0								
8	10.5	12.5								
10	13.9	17.1	20.2							
12		22.6	27.2	31.7						
14		29.2	35.4	41.6	47.8					
16			44.9	53.0	61.1	69.2				
18			55.6	65.9	76.1	86.4	96.6			
20				80.3	93.0	105.6	118.3	130.9		
22				96.2	111.5	126.9	142.2	157.5	172.8	
24					131.9	150.1	168.3	186.5	204.8	223.0
26					154.0	175.4	196.8	218.2	239.5	260.9
28						202.7	227.5	252.3	277.1	301.9
30						232.1	260.5	289.0	317.5	345.9
32							295.8	328.2	360.6	393.0
34							333.4	369.9	406.5	443.1

Equation: $W = 4.41826 + 0.01581D^2H$ ($R^2 = 0.97$, N = 51)
Equation based on D only: $W = -6.71986 + 1.45939D + 0.06920D^2 + 0.00566D^3$
($R^2 = 0.93$, N = 51)

Jack pine (*Pinus banksiana* Lamb.) whole tree aboveground biomass (kg) with foliage

Dbh (cm)	Height (m)										
	6	8	10	12	14	16	18	20	22	24	26
6	9.9	11.1	12.4								
8	12.8	15.1	17.4	19.6							
10		20.2	23.7	27.3	30.8						
12		26.4	31.5	36.6	41.7	46.8					
14			40.7	47.6	54.5	61.5	68.4				
16			51.3	60.3	69.4	78.4	87.5	96.5			
18				74.8	86.2	97.7	109.1	120.6			
20				90.9	105.0	119.1	133.3	147.4	161.6		
22				108.7	125.8	142.9	160.0	177.1	194.2		
24					148.5	168.9	189.3	209.6	230.0	250.3	
26					173.3	197.2	221.1	245.0	268.8	292.7	316.6
28					200.0	227.7	255.4	283.1	310.8	338.5	366.2
30						260.5	292.3	324.1	355.9	387.7	419.5
32						295.6	331.8	367.9	404.1	440.3	476.5
34						332.9	373.7	414.6	455.4	496.3	537.1
36							418.3	464.1	509.9	555.7	601.5
38								516.4	567.4	618.4	669.5

Equation: $W = 6.05712 + 0.01767D^2H$ ($R^2 = 0.98$, N = 56)
Equation based on D only: $W = -95.54713 + 21.16062D - 1.04327D^2 + 0.02434D^3$
($R^2 = 0.93$, N = 56)

Jack pine (*Pinus banksiana* Lamb.) whole tree aboveground biomass (kg) without foliage

Dbh (cm)	Height (m)										
	6	8	10	12	14	16	18	20	22	24	26
6	9.5	10.6	11.8								
8	12.2	14.3	16.4	18.4							
10		19.0	22.2	25.5	28.8						
12		24.7	29.4	34.1	38.8	43.5					
14			37.9	44.3	50.7	57.0	63.4				
16			47.7	56.0	64.3	72.7	81.0	89.4			
18				69.3	79.9	90.4	101.0	111.6			
20				84.2	97.2	110.3	123.3	136.3	149.4		
22				100.6	116.4	132.2	147.9	163.7	179.5		
24					137.4	156.2	174.9	193.7	212.5	231.3	
26					160.2	182.2	204.3	226.3	248.3	270.4	292.4
28					184.8	210.4	236.0	261.5	287.1	312.6	338.2
30						240.7	270.0	299.3	328.7	358.0	387.4
32						273.0	306.4	339.8	373.1	406.5	439.9
34						307.4	345.1	382.8	420.5	458.2	495.8
36							386.2	428.4	470.7	512.9	555.2
38								476.7	523.7	570.8	617.9

Equation: $W = 5.93029 + 0.01630D^2H$ ($R^2 = 0.99$, N = 56)
Equation based on D only: $W = -100.61940 + 22.15374D - 1.10697D^2 + 0.02475D^3$
($R^2 = 0.94$, N = 56)

Tamarack larch (*Larix laricina* (Du Roi) K. Koch) whole tree aboveground biomass (kg) with foliage

Dbh (cm)	Height (m)										
	6	8	10	12	14	16	18	20	22	24	26
6	10.1	11.3									
8	13.0	15.2	17.4								
10	16.7	20.1	23.6	27.1							
12		26.2	31.2	36.2	41.2						
14		33.4	40.2	47 0	53.7	60.5					
16			50.6	59.4	68.3	77.1					
18			62.3	73.5	84.7	95.9	107.1				
20				89.3	103.1	116.9	130.7				
22				106.7	123.4	140.1	156.9	173.6			
24					145.7	165.6	185.5	205.4	225.3		
26					169.9	193.2	216.6	239.9	263.3	286.7	310.0
28					196.0	223.1	250.2	277.3	304.4	331.5	358.6
30						255.2	286.3	317.4	348.5	379.6	410.7
32							324.8	360.2	395.6	431.0	466.4
34							365.9	405.8	445.8	485.7	525.7

Equation: $W = 6.32169 + 0.01728D^2H$ ($R^2 = 0.97$, N = 56)
Equation based on D only: $W = 7.06302 - 3.01775D + 0.48754D^2 - 0.00329D^3$
($R^2 = 0.97$, N = 56)

Tamarack larch (*Larix laricina* (Du Roi) K. Koch) whole tree aboveground biomass (kg) without foliage

Dbh (cm)	Height (m)										
	6	8	10	12	14	16	18	20	22	24	26
6	8.9	10.1									
8	11.6	13.8	15.9								
10	15.2	18.5	21.8	25.1							
12		24.4	29.1	33.9	38.7						
14		31.2	37.7	44.2	50.7	57.2					
16			47.7	56.1	64.6	73.1					
18			58.9	69.6	80.4	91.1	101.8				
20				84.7	98.0	111.2	124.4				
22				101.4	117.4	133.4	149.5	165.5			
24					138.7	157.8	176.9	195.9	215.0		
26					161.9	184.3	206.7	229.0	251.4	273.8	296.2
28					186.9	212.9	238.8	264.8	290.7	316.7	342.6
30						243.6	273.4	303.2	333.0	362.8	392.6
32							310.3	344.2	378.1	412.0	445.9
34							349.7	387.9	426.2	464.4	502.7

Equation: $W = 5.28648 + 0.01655D^2H$ ($R^2 = 0.97$, N = 56)
Equation based on D only: $W = 4.67782 - 2.38151D + 0.42265D^2 - 0.00211D^3$
($R^2 = 0.97$, N = 56)

Trembling aspen (*Populus tremuloides* Michx.) whole tree aboveground biomass (kg) with foliage

Dbh (cm)	Height (m) 6	8	10	12	14	16	18	20	22	24	26	28
6	11.2	12.5	13.7									
8	14.1	16.3	18.5	20.7								
10		21.2	24.6	28.0	31.5							
12		27.2	32.1	37.1	42.0	46.9						
14			41.0	47.7	54.4	61.1	67.8					
16			51.3	60.0	68.8	77.5	86.3	95.0				
18					85.1	96.1	107.2	118.3	129.3			
20					103.2	116.9	130.6	144.3	157.9			
22						139.9	156.4	173.0	189.5	206.0		
24							184.7	204.4	224.1	243.8	263.5	
26							215.5	238.6	261.7	284.8	307.9	331.0
28								275.5	302.3	329.1	355.9	382.7
30								315.2	345.9	376.7	407.4	438.2
32									392.5	427.5	462.5	497.5
34									442.2	481.7	521.2	560.7
36									494.8	539.1	583.4	627.7
38										599.8	649.2	698.5
40										663.8	718.5	773.2

Equation: $W = 7.53108 + 0.01709D^2H$ ($R^2 = 0.97$, N = 56)
Equation based on D only. $W = -2.86334 - 0.76994D + 0.32606D^2 + 0.00362D^3$
($R^2 = 0.98$, N = 56)

Trembling aspen (*Populus tremuloides* Michx.) whole tree aboveground biomass (kg) without foliage

Dbh (cm)	Height (m) 6	8	10	12	14	16	18	20	22	24	26	28
6	9.8	11.0	12.3									
8	12.7	14.8	17.0	19.2								
10		19.7	23.1	26.5	29.9							
12		25.7	30.6	35.5	40.4	45.3						
14			39.4	46.1	52.7	59.4	66.0					
16			49.6	58.3	67.0	75.7	84.4	93.0				
18					83.1	94.1	105.1	116.1	127.1			
20					101.2	114.8	128.3	141.9	155.5			
22						137.6	154.0	170.4	186.9	203.3		
24							182.1	201.7	221.2	240.8	260.3	
26							212.6	235.6	258.5	281.5	304.4	327.4
28								272.2	298.9	325.5	352.1	378.7
30								311.6	342.2	372.7	403.3	433.8
32									388.5	423.2	458.0	492.7
34									437.7	477.0	516.2	555.4
36									490.0	534.0	578.0	622.0
38										594.3	643.3	692.3
40										657.8	712.1	766.4

Equation: $W = 6.15737 + 0.01697D^2H$ ($R^2 = 0.97$, N = 56)
Equation based on D only: $W = -1.94053 - 0.96372D + 0.32405D^2 + 0.00370D^3$
($R^2 = 0.98$, N = 56)

White spruce (*Picea glauca* (Moench) Voss) whole tree aboveground biomass (kg) with foliage

Dbh (cm)	Height (m) 6	8	10	12	14	16	18	20	22	24	26	28
6	11.6	12.6										
8	14.0	15.8	17.6									
10		19.9	22.7	25.6								
12		24.9	29.0	33.1	37.2							
14			36.4	42.0	47.6	53.2						
16			45.0	52.3	59.6	66.9	74.2					
18				64.0	73.2	82.5	91.7	100.9				
20					88.4	99.8	111.2	122.6	134.1			
22					105.2	119.0	132.8	146.6	160.4			
24						140.0	156.4	172.9	189.3	205.7		
26						162.8	182.1	201.4	220.7	240.0	259.3	
28							209.9	232.2	254.6	277.0	299.4	321.7
30							239.6	265.3	291.0	316.7	342.4	368.1
32								300.7	329.9	359.2	388.4	417.6
34								338.4	371.4	404.4	437.4	470.4
36									415.3	452.3	489.3	526.3
38									461.8	503.0	544.2	585.4

Equation: $W = 8.47531 + 0.01427D^2H$ ($R^2 = 0.98$, N = 61)
Equation based on D only. $W = 36.56038 - 10.62749D + 0.93837D^2 - 0.01032D^3$
($R^2 = 0.94$, N = 61)

White spruce (*Picea glauca* (Moench) Voss) whole tree aboveground biomass (kg) without foliage

Dbh (cm)	Height (m) 6	8	10	12	14	16	18	20	22	24	26	28
6	9.9	10.9										
8	12.1	13.8	15.6									
10		17.7	20.4	23.0								
12		22.4	26.2	30.1	33.9							
14			33.1	38.4	43.6	48.8						
16			41.1	48.0	54.8	61.6	68.4					
18				58.8	67.5	76.1	84.8	93.4				
20					81.7	92.3	103.0	113.7	124.3			
22					97.3	110.2	123.2	136.1	149.0			
24						129.9	145.2	160.6	175.9	191.3		
26						151.2	169.2	187.2	205.3	223.3	241.3	
28							195.1	216.0	236.9	257.8	278.7	299.6
30							223.0	247.0	271.0	294.9	318.9	342.9
32								280.0	307.3	334.6	361.9	389.2
34								315.2	346.0	376.8	407.7	438.5
36									387.1	421.6	456.2	490.7
38									430.5	469.0	507.5	546.0

Equation. $W = 7.02154 + 0.01333D^2H$ ($R^2 = 0.99$, N = 61)
Equation based on D only: $W = 28.94398 - 8.66436D + 0.78950D^2 - 0.00803D^3$
($R^2 = 0.95$, N = 61)

Canada

Northern Forest Research Centre
5320 - 122 Street
Edmonton, Alberta
T6H 3S5 (403) 435-7210

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